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Patricia C. Harms

Iowa State University

Steven K. Mickelson

Iowa State University, estaben@iastate.edu

Thomas J. Brumm

Iowa State University, tbrumm@iastate.edu

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Using a First-Year Learning Community to Help Meet Departmental Program Objectives in Agricultural & Biosystems Engineering

Patricia C. Harms, Steven K. Mickelson, Thomas J. Brumm
Iowa State University

Abstract

A current trend on many college campuses is the implementation of student learning communities. At Iowa State University, we have found that our first-year learning community has provided an opportunity for agricultural engineering students to become involved in the Agricultural and Biosystems Engineering (ABE) department from the moment they arrive on campus. Not only has the learning community helped us increase our retention from 47.6 percent for the 1997/1998 academic year to 86.2% for the 1999/2000 academic year, it has helped us to address many of our program objectives including: an ability to function on multi-disciplinary teams, an ability to communicate effectively, and knowledge of important contemporary issues. Our formal assessment of the initiative reveals that students are overwhelmingly satisfied with the program.

Introduction

The term “learning communities” has become increasingly prominent in the literature since the late 1980s¹. According to Huba², “A learning community can be defined as a small group of students, mostly freshmen, who work closely together as a community of learners within the larger community of the university. By sharing classes and/or living space, students form close friendships as part of an innovative program in cooperative learning” (p. 1). Initially created in an effort to increase student retention and improve student learning, learning communities continue to gain popularity as college administrations and faculty become aware of the benefits to students and to universities. Student involvement in learning communities at Iowa State University (ISU) has steadily increased since they “began...as a grass roots effort in 1994, with the first learning community implemented in the fall of 1995. Within the past three years, student participation in learning communities has grown from 1,114 [students] in 1998 to 1,779 in 1999 to 1,838 in 2000” (Huba, p. 1).

At large research based universities, like ISU, it is often difficult for undergraduate students to become engaged in the university, an issue highlighted by the Boyer Commission’s 1998 report³. Learning communities are one innovation designed to address this difficulty. Furthermore, for engineering programs in particular, engaging (and retaining) new students is extremely important as the demand for engineering graduates is increasing, while the number of students obtaining engineering degrees is about constant⁴. No longer can engineering departments ignore the need for retention programs for increasing the number of their graduates. In light of this fact, engineering college administrations are increasingly evaluating departments on outcome-based objectives related to retention and graduation rates. These outcomes are typically highly

correlated to the new ABET program outcomes criteria commonly referred to as A-K (available at <http://www.abet.org>).

In addition to the positive impact learning communities have on retention, learning communities have been found to help students meet both academic and social needs, “without having to sacrifice one to address the other”⁵. According to Cross⁶, learning communities are more than just another curricular fad. Why are educators so impressed with learning communities? Cross argues the reasons fit into three categories: “*philosophical* (because learning communities fit into a changing philosophy of knowledge), *research based* (because learning communities fit with what research tells us about learning), and *pragmatic* (because learning communities work)” (original italics, p. 4).

In this paper we will describe the Agricultural and Biosystems Engineering (ABE) first-year learning community at Iowa State University, a learning community that includes linked courses, a living community option, peer mentors and tutors, faculty-student dinners, and service learning opportunities. We have found that our learning community has dramatically increased student retention^a (from 47.6 percent for the 1997/1998 academic year to 86.2% for the 1999/2000 academic year) and has helped us to address many of our program objectives. We will also present data gathered through student surveys and student focus groups.

Description of the ABE Learning Community Initiative

The Agricultural and Biosystems Engineering (ABE) Department joined the Iowa State University (ISU) Learning Community (LC) initiative hoping to increase our student retention and to meet program objectives. We saw the learning community as a potential opportunity for our students to build community between each other, the faculty, the department, and the university. The ABE Department at ISU is unique in that it is situated in two colleges. Students majoring in agricultural engineering (AE) are in the College of Engineering. Conversely, students majoring in agricultural systems technology (AST) are in the College of Agriculture. Perhaps not surprisingly, this often creates dissonance between the students, the same individuals who will eventually be working together in industry. The university learning community initiative provided funding for the ABE LC, which was awarded through a competitive proposal process at the university level.

The ABE LC includes two primary components: the *learning* community, which is created by having students co-enroll for specially selected linked courses, and the *living* community, a reserved portion of a specific residence hall. All students are encouraged to participate in either or both aspects of the LC, although participation for the learning community is more strongly encouraged (but not mandatory). A learning community has been established for each of the two departmental majors (AE and AST); a separate community is necessary for each due to curricular differences. The living community is offered to students who select either major. Other features of our LC include peer mentors and tutors, faculty-student dinners, and student service learning opportunities. Prior to program implementation, both general and specific learning community objectives were identified.

^aRetention is defined as first-time/first-semester agricultural engineering (AE) college students who have remained in the AE curriculum through the tenth day of the first-semester of their sophomore year.

ABE Learning Community Objectives

The following general objectives were established for the ABE LC:

- To build community for entering first-year students within the AE and AST curricula
- To increase the retention of the first-year students in the AE and AST programs
- To increase recruitment of students into the ABE curricula, especially underrepresented students (women and minorities)
- To enhance learning and team skills using collaborative, learning-based educational methodology in the learning community courses
- To improve written communication skills by creating a writing link between the first-year composition courses and other technical courses in the AE and AST curricula

Specific objectives for the ABE LC were also identified:

- To build excitement for the fields of engineering and technology
- To increase student involvement within the department of ABE
- To increase student interaction with the ABE faculty
- To increase student interaction with ABE upper-level students
- To have students learn the differences between the options within the AE and AST curricula
- To develop team skills through the use of collaborative, learning-based assignments
- To introduce students to various problems (areas of interest) within the agricultural engineering and technology field
- To experience hands-on laboratories related to the AE and AST options
- To increase involvement in professional societies and student branch
- To introduce technical writing skills during the first year of study
- To make the first-year composition courses more meaningful to the students
- To establish career development/job preparation
- To receive academic guidance related to curriculum issues

These general and specific ABE LC objectives were designed to help our department meet the following college and departmental objectives:

College Undergraduate and Learning Objectives:

- In order to transition from a teaching- to a learning-based educational system, at least 75 percent of engineering faculty members will use collaborative, learning-based educational methodology in their courses.
- Total bachelor's degrees awarded will be 900 per year with approximately 35 percent to women and 8 percent to underrepresented minorities.

Departmental Undergraduate and Learning Objectives:

The objective of the academic program in agricultural engineering is to produce graduates who should have:

- An ability to apply knowledge of mathematics, science, and engineering in solving engineering problems
- An ability to design and conduct experiments, and to analyze and interpret experimental data

- An ability to function on multi-disciplinary teams
- An ability to identify, formulate, and solve engineering problems related to production, processing, storage, handling, distribution, and use of food and other biological products worldwide, and the responsible management of the environment and natural resources
- An understanding of professional and ethical responsibility
- An ability to use the techniques, skills, and engineering tools needed for engineering practice
- A recognition of the need for, and an ability to engage in, life-long learning
- An ability to communicate effectively
- The knowledge to understand impacts of engineering solutions locally, nationally, and globally
- A knowledge of important contemporary issues
- A demonstrated knowledge of agricultural and/or biological sciences, and natural resource topics appropriate for a chosen option area

Student Recruitment

Students for the learning and living communities were recruited through university, college, and department mailings and contacts. The ABE learning community descriptions were included in the *Iowa State University: Learning Communities* brochure, which is made available to prospective students through the Admissions Office, and the ISU learning communities website (available at <http://www.iastate.edu/learncommunity>). Links to the ABE learning community descriptions were added to the College of Engineering homepage. In addition, personalized contact was made with students through letters sent in March to entering students who declared either AE or AST as their major and in person during various ISU recruiting events and student orientation, which is when fall registration takes place.

Learning Community Courses and Course Links

In an effort to build a sense of community between the first-year students, a common set of core courses was identified for the incoming students in each major. Students must participate in two of the three identified courses each semester in order to participate in the learning community.

AST Learning Community Core

Fall Learning Community Core

- AST 110 (0.5 cr.) Orientation in Agricultural Systems Technology
- Chem 167 (5 cr.) General Chemistry and Lab
- Engl 104 (3 cr.) First-Year Composition I (AST/AE section)

Spring Learning Community Core

- Math 142 (3 cr.) Trigonometry and Analytical Geometry
- AST 181 (3 cr.) Micro computer Applications in Agriculture
- Engl 105 (3 cr.) First-Year Composition II

AE Learning Community Core

Fall Learning Community Core

- Engr 101 (R cr.)^b Engineering Orientation for AE Students
- Engr 170 (3 cr.) Engineering Graphics and Design (AE section)
- Engl 104 (3 cr.) First-Year Composition I (AE/AST section)

Spring Learning Community Core

- A E 110 (1 cr.) Experiencing Agricultural & Bioystems Engineering
- Engr 160 (3 cr.) Engineering Problem Solving with Visual Basic Programming (AE section)
- Engl 105 (3 cr.) First-Year Composition II (AE section)

The AE students have a writing link between their engineering courses (Engr 170, Engr 101, AE 110, and Engr 160) and the first-year composition courses (Engl 104 and Engl 105), while the AST students link the first-year composition courses with their first technology classes (AST 110 and AST 181). A learning community coordinator from the English Department helped to coordinate this link. Engr 101, AE 110, Engineering 170, AST 110, and AST 181 are offered as ABE sections only and are taught by ABE faculty.

In the fall semester, AST and AE students are placed in the same section of the English 104 course. By placing both majors in one section we were able to fill one section of English 104 (26 students) with our students, a situation we hoped would help build community between the two majors.^c In the spring semester, we were able to fill one section of English 105 with AE students, and the AST students were placed into a separate English 105 section. During Spring 2001 semester, the AE and AST students shared a section of English 105 due to smaller numbers of students needing English 105.

ABE Living Community

The ABE Department offers an optional living community that complements the curriculum-based first-year learning communities. The ABE LC coordinator worked with the Program Coordinator of Residence Halls to establish housing for both the AE and AST entering first-year students. Located in a newly renovated residence hall, the goal of the ABE living community is to develop greater unity and collaboration between students in the two programs. Since both majors are administered within the same department and by the same faculty, it is anticipated that increasing interaction through this living community will help to build better harmony and cooperation amongst the AE and AST students.

Peer Mentors and Tutors

Peer mentors are hired each year by the ABE LC coordinator for each of the AE core groupings listed previously. The mentors are paid on an hourly basis with funds from our university grant

^b R cr. is an abbreviation for *required credit*. Engineering 101 is a course that all engineering students must take, but it is a course for which students receive no formal course credit.

^c At Iowa State University (ISU), students are placed into first-year composition based on their ACT scores; therefore, many of our students majoring in engineering test out of English 104 due to their high ACT scores. In addition, some students bring college credit for English when they matriculate from high school; therefore, not all ABE students take English 104 or even English 105 at ISU.

and are in place to help us meet our LC objectives, specifically to build community within the department, to increase student interaction with upper-level ABE students, to build excitement for the fields of engineering and technology, and to receive academic guidance. The responsibilities for the student mentors include:

- Attending one of the core group classes each week
- Participating in-group activities in and outside the classroom
- Answering academic/curriculum questions
- Referring students to the correct academic resources
- Coordinating out-of-class activities
- Providing feedback on classroom assignments
- Providing in-class guidance when appropriate
- Meeting with the core group coordinator once a week

The upper-level students have apparently enjoyed the opportunities to mentor. During the first two years, students were recruited by the LC coordinator to participate. For the current year, the mentors were selected from a group of students who contacted the coordinator to ask if they could participate.

Tutoring for math and physics courses is also provided for students majoring in AE. We selected these courses because they tend to be the most difficult for our students. Sessions are held with the tutors twice each week at times and locations convenient for the students and the tutors.

Faculty-Student Dinners

Once each semester, members of the ABE faculty and other linked course instructors join students who live in the ABE living community for appetizers and dinner. The department of residence caters the pre-dinner appetizers on the students' floor in their community meeting room. During this informal time, students and faculty have time to talk and get acquainted outside the traditional classroom setting. The group then moves down to the residence dining hall for dinner. The events are handled rather informally (faculty and students are invited by the ABE LC coordinator via email) and through announcements/reminders in the linked courses.

Service Learning Opportunities

At this time, only those students who live in the ABE living community are involved in service learning. Service learning is a requirement of the residence hall, and students are required to volunteer five hours of community service over the course of each semester. During the 1999-2000 academic year, the students decided to volunteer collectively; they worked on a Habitat for Humanity House. Students living in the living community in 2000-2001 voted to volunteer individually. Increasing the ABE LC service learning opportunities for students is one of our future goals.

Results

Ongoing assessment is an important aspect of the administration of our learning community. In addition to our LC coordinator who performs assessment responsibilities, we have hired a half-time doctoral student researcher. Both quantitative and qualitative data have been collected and are highlighted below.

1999-2000 Post-Survey

A post-survey was conducted at the end of the 1999-2000 academic year to evaluate the LC students' perceptions and attitudes related to each of the specific ABE LC objectives. Forty AST and AE students completed the survey.

Figure 1 shows the average score from the responses received related to twelve different statements given to the students in the survey. A response of a three or higher means that the student agreed or strongly agreed with a statement. A score lower than a three is correlated with a student who disagreed or strongly disagreed with a statement. A score of a three or higher was desired to verify that an objective had been met successfully. For all twelve statements, an average score of a three or higher was received. The statements that dealt with faculty interaction and support (statements 3 and 11) received two of the highest average scores. Although the statement related to student involvement in a professional society or student organization (statement 9) received the lowest average score with a 3.11, it was still above the minimum score desired. The results from this survey help to confirm that the ABE LC is meeting our expectations by meeting each of last years' pre-defined specific program objectives.

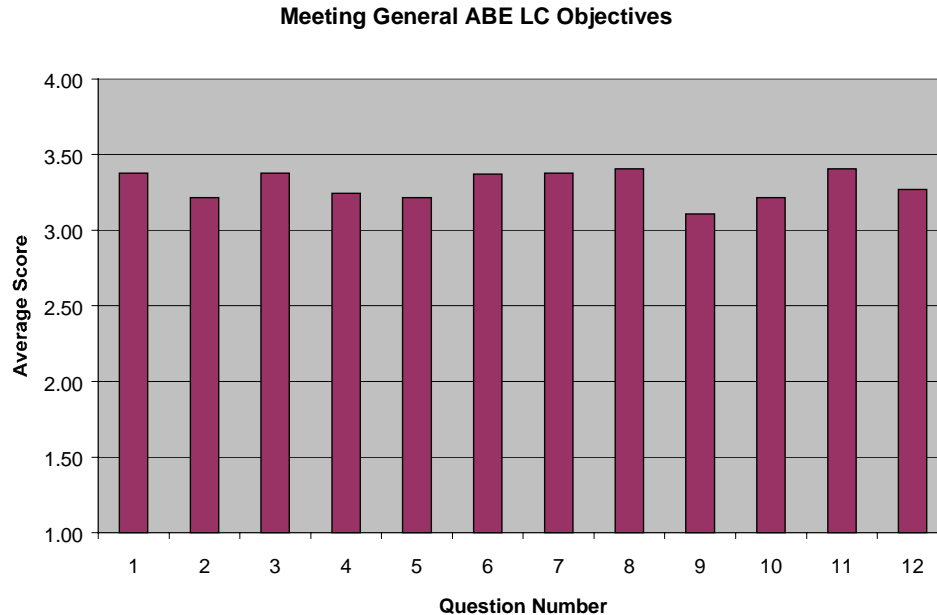


Figure 1. Average responses (N=40) to the following ABE learning community statements (1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree):

1. I am excited to be a part of the field of engineering and technology.
2. I have been involved with the ABE Department this year.
3. I have interacted with the ABE faculty this year.
4. I have interacted with upper-class ABE students this year.
5. I understand the differences between the options within the AE or AST curriculum.
6. I have developed or enhanced my team skills through collaborative assignments in my learning community classes.
7. I have been introduced to various problems (areas of interest) within the ag engineering and technology field.
8. I have experienced hands-on laboratories related to the AE or AST options.
9. I have become involved in a professional society or a student organization.
10. I have learned technical writing skills this year.
11. I have received support from the ABE faculty this year.
12. I have received guidance related to curriculum issues.

Student Experience Survey for AE Students

A separate survey was given prior to and following the spring semester LC link for the AE students. The first part of the survey was designed to determine student attitudes related to their experience at the University, the help they had received at the college and the department levels, and their perceptions about whether or not they had chosen the correct major. The results of the AE students' perceptions are shown in Figure 2.

Students perceived that the help they were receiving from the College of Engineering (COE) was not as much as they had hoped, perhaps due to the perceived need for help from the college related to their problems with the calculus and/or physics courses. These courses tend to be two

of the most difficult courses for a majority of our first-year engineering students. As noted previously, the ABE department did provide tutoring for physics and calculus for those who needed it. Two upper-level students were hired for two 2-hour tutoring sessions a week related to these courses. The availability of these tutors may help explain why the students perceived the help they received from the ABE department as being better by the end of the semester.

Students also perceived their experience at ISU as getting better by the end of the semester. The most encouraging result was that of knowing if AE was the correct major for the students. This score also increased slightly by the end of the semester. This correlated highly with the 86.2 percent retention rate at the end of the 1999/2000 academic year for those who had started out in the AE major. This, compared to the 47.6 percent retention rate for the 1997/1998 academic year, helps to verify the success of the ABE LC initiative.

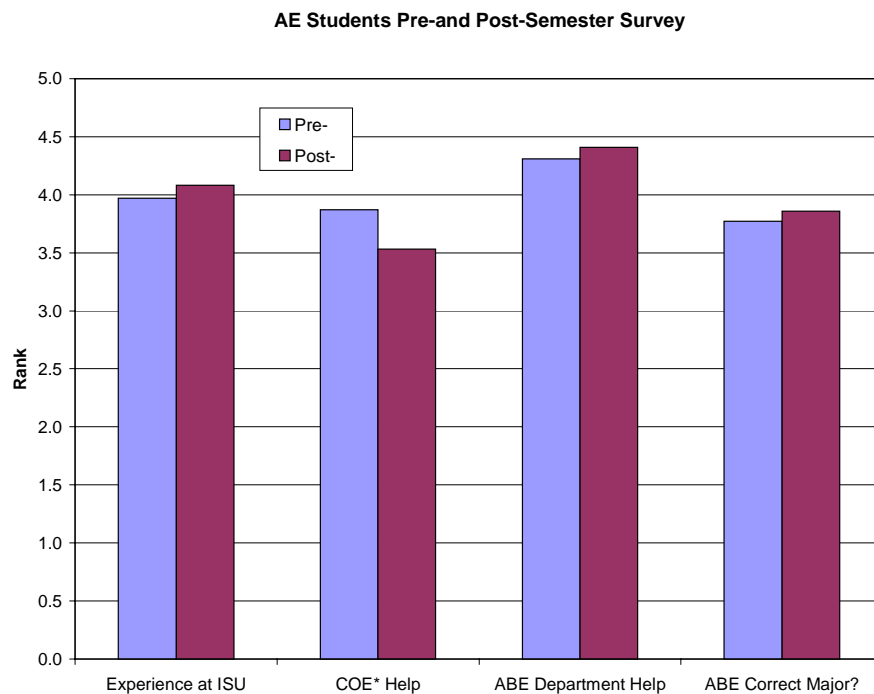


Figure 2. AE students reported perceptions at the beginning and end of the Spring 2000 semester (N=37).

*COE = College of Engineering

The second part of the survey was designed to determine the level of familiarity with other AE students and AE faculty. Two questions were posed to the students: (1) About how many students in ABE do you know well enough to engage in a conversation? And (2) About how many faculty in ABE do you know well enough to engage in a conversation? The responses to these questions, as shown in Figures 3 and 4, may help to explain why the retention rate for the AE major has increased so significantly. One of our goals from our ABE LC objectives list was to increase the interaction of the first-year students with faculty.

Figure 3 shows on the average, the number of faculty within the department that the AE first-year students knew well enough to engage in a conversation with at the beginning and end of the spring semester. At the beginning of the semester, slightly over 20 percent of the students claimed to know three faculty well enough to engage in a conversation. The rest of the students knew 2 or less faculty well enough. By the end of the spring semester, 68 percent of the AE students knew 3 or more faculty well enough to engage in a conversation. The students had formal opportunities to interact with the faculty in the linked AE 110 course (Experiencing AE), a hands-on laboratory course. In this course, students had an opportunity to meet with several faculty in a mentoring setting and in a lab setting. The faculty-student dinners also provided opportunities for interaction.

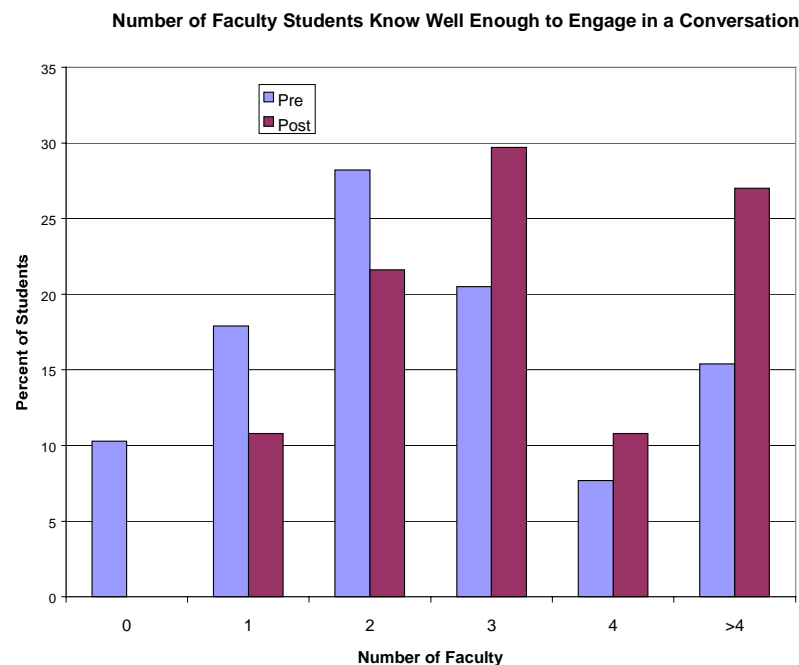


Figure 3. First-year students' familiarity with ABE faculty before and after the Spring 2000 semester (N=37).

Figure 4 shows the number of students at each class level that the first-year students knew well enough to engage in a conversation. By the end of the spring semester, 100 percent of the students knew at least one other first-year student well enough to engage in a conversation; 95 percent knew a sophomore well enough to engage in a conversation; 70 percent knew a junior well enough to engage in a conversation; and 70 percent knew a senior well enough to engage in a conversation. These results are dramatically different than at the beginning of the semester. Most of this change can most likely be attributed to the mentoring provided in AE 110 and Engr 160, and for those involved, the living community.

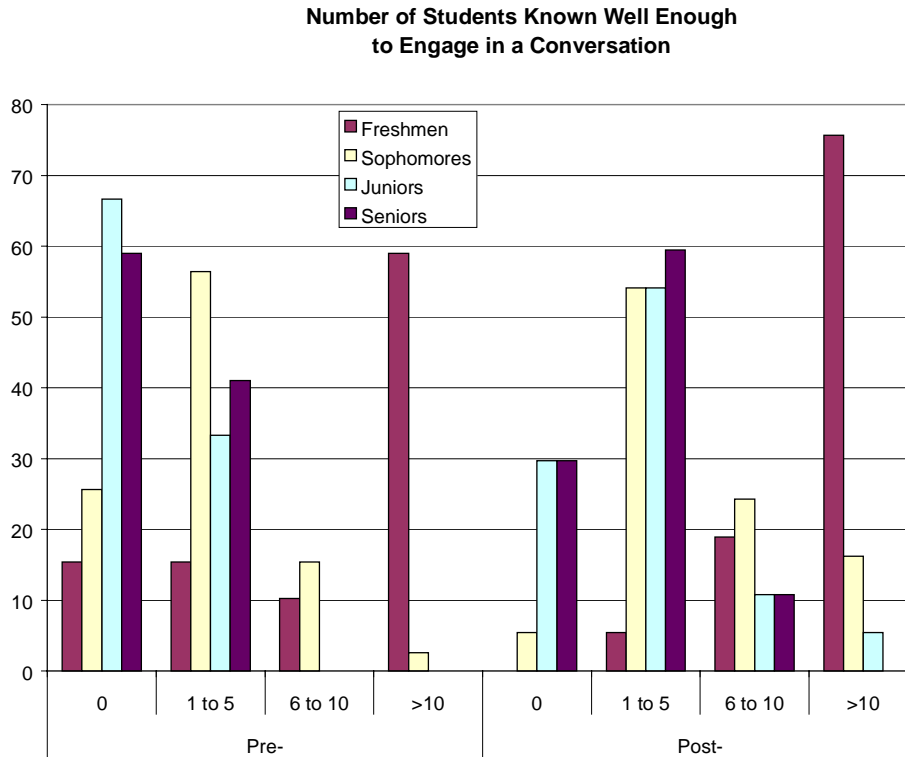


Figure 4. First-year students' familiarity with AE students before and after the Spring 2000 semester ($N=37$).

Focus Group Results

In an effort to enhance our understanding of the students' experiences with the learning community, we held student focus groups during the Fall 2000 semester. Nine first-year, first-semester AE students volunteered to participate. All of these students were co-enrolled in Engineering 170, Engineering 101, and English 104. Three focus groups were held at regular intervals throughout the semester. Not surprisingly, many of the students' responses tended to correlate with the timing of the semester.

At the beginning of the semester, the students were pretty excited about their learning community experience as demonstrated by this remark:

"It's kind of a good plan, the whole thing, the whole learning community is when we're all grouped up in classes together and we all kind of have the same, the same general ideas about what we want from school...what classes we want to take, what classes we are gonna take together, you know" ("Tony", September 27, 2000).

Around mid-term, the following remark is representative of how overwhelmed many of the students were feeling:

"I'm thinking for English 104 that she wants an ungodly amount of work that we're supposed to do...It's insane. It's 104; I don't think we should be working this hard" (Jay, October 25, 2000).

By the end of the semester, many of the students were able to see the benefit of having had to work so hard over the last few months:

"I did not like that class...I'm just not an English person. Never have been. In high school, didn't like it. But when it comes to, we're writing a paper for engineering right now you know, and I think it's really benefited me, you know when it comes to writing that...I think it's really benefited me to have that class" (Kory, December 6, 2000).

"Speaking of audience changes, I, if it wasn't for the English class I probably wouldn't have noticed this in the [Engineering 170] presentations, but when ["Jay"], when they were doing their presentation. First they started off with some audience. Did you notice that, too? And then he got off and he like addressed us like we were students. I was like, Uh, I don't think you're supposed to do that" (Bruce, December 6, 2000).

One focus group participant also offered the faculty a suggestion for making an improvement with the linked classes:

"You just need to [get] a little bit better organized, so we're not doing the same project for each class at the same time. I mean, for a little while there...I was getting my two groups mixed up. It wasn't too bad, but if we could set them apart a little better, so we're not totally getting it all messed up or something" (Chad, December 6, 2000).

The other participants were quick to agree: having to do different collaborative projects in Engineering 170 and English 104 at the same time in the semester (each with different group members) was confusing.

Conclusion

In conclusion, the overall objectives of the ABE LC were largely met by the end of the academic year:

- A living/learning community was established for entering first-year students within the AE and AST curricula
- The retention of the first-year students in the AE and AST programs increased dramatically when compared to the most recent academic year when no LC was available (47.6 percent to 86.2 percent)
- Recruitment of students into the ABE programs has not dramatically changed, especially for women and minorities, although those students we do recruit we are now retaining
- Collaborative, learning-based educational methodology was implemented in the learning community courses to enhance learning and team skills
- A successful writing link was created between the first-year composition courses and other technical courses in the AE and AST curriculum

Although we are extremely satisfied by the success of the ABE LC, we believe improvements can still be made. Our current to-do list includes the following items:

1. Increase faculty support of this program
2. Increase opportunities for LC collaboration with other ISU LCs to enhance students' experiences
3. Enhance collaboration and communication between the instructors teaching linked courses
4. Expand efforts to recruit underrepresented students
5. Develop web-based recruitment materials and improve information availability
6. Secure funding from other sources beyond the university funds currently available

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PATRICIA C. HARMS

Patty Harms is a doctoral candidate in rhetoric and professional communication at Iowa State University (ISU). She has been very involved in learning communities at ISU, and her dissertation explores the effects of "linked courses" on engineering students' developing written and visual literacy. Ms. Harms has taught first-year composition I and II for the ISU Agricultural and Biosystems Engineering Learning Community. She has also taught business communication and visual communication in business and technical writing. Ms. Harms' research interests include learning communities, writing across the curriculum, and assessment in higher education. She has a Bachelor of Science degree in nursing from the University of Pennsylvania and a Master of Arts degree in business and technical communication from ISU.

STEVEN K. MICKELSON

Steven K. Mickelson is an Associate Professor of Agricultural and Biosystems Engineering (ABE) at Iowa State University. Dr. Mickelson is the teaching/advising coordinator for the ABE department. His teaching specialties include computer-aided graphics, engineering design, soil and water conservation engineering, and land surveying. His research areas include soil quality evaluation using x-ray tomography, evaluation of best management practices for reducing surface and groundwater contamination, and manure management evaluation for environmental protection of water resources. Dr. Mickelson has been very active in the American Society for Engineering Education for the past 16 years. He received his Agricultural Engineering Degrees from Iowa State University in 1982, 1984, and 1991.

THOMAS J. BRUMM

Dr. Thomas J. Brumm is Assistant Professor in the Department of Agricultural and Biosystems Engineering (ABE) at Iowa State University (ISU). Before joining the ISU faculty in 2000, he worked in the seed industry for 10 years. He leads the Agricultural Systems Technology curriculum in the ABE department. His technical expertise includes: near-infrared analysis technology; grain processing; grain and seed quality; and the evaluation of grains and oilseeds for food and feed use. He received Bachelor's degree from ISU, and his Master's degree from Purdue University, both in Agricultural Engineering. He received his Ph.D. from ISU in 1990 in Agricultural Engineering with a minor in Chemical Engineering.